United States Patent [19]

Chernock

[11] **3,961,876**

[45] **June 8, 1976**

[54] **VALVE ASSEMBLY**

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[22] Filed: **June 6, 1974**

[21] Appl. No.: **477,037**

[52] **U.S. Cl.** **431/344**; 431/254; 431/277; 251/320; 251/323

[51] **Int. Cl.²** **F23D 13/04**

[58] **Field of Search** 431/130, 131, 142, 143, 431/150, 254, 276, 277, 344; 222/3; 251/322, 354, 320; 137/537

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Primary Examiner—Carroll B. Dority, Jr.
Attorney, Agent, or Firm—Mattern, Ware, Davis & Stoltz

[57] **ABSTRACT**

By externally mounting a resiliently flexible member about a valve stem so as to biasingly engage the valve stem with the valve housing in the closed position, a unique, self-contained, captured valve assembly is provided. In the preferred embodiment, the flexible biasing member comprises a rubber material which peripherally surrounds the valve stem and the valve housing. This valve assembly is particularly useful in gas lighters of the butane fuel type, since the preferred embodiment provides a seal against leakage and secondary ignition.

4 Claims, 6 Drawing Figures

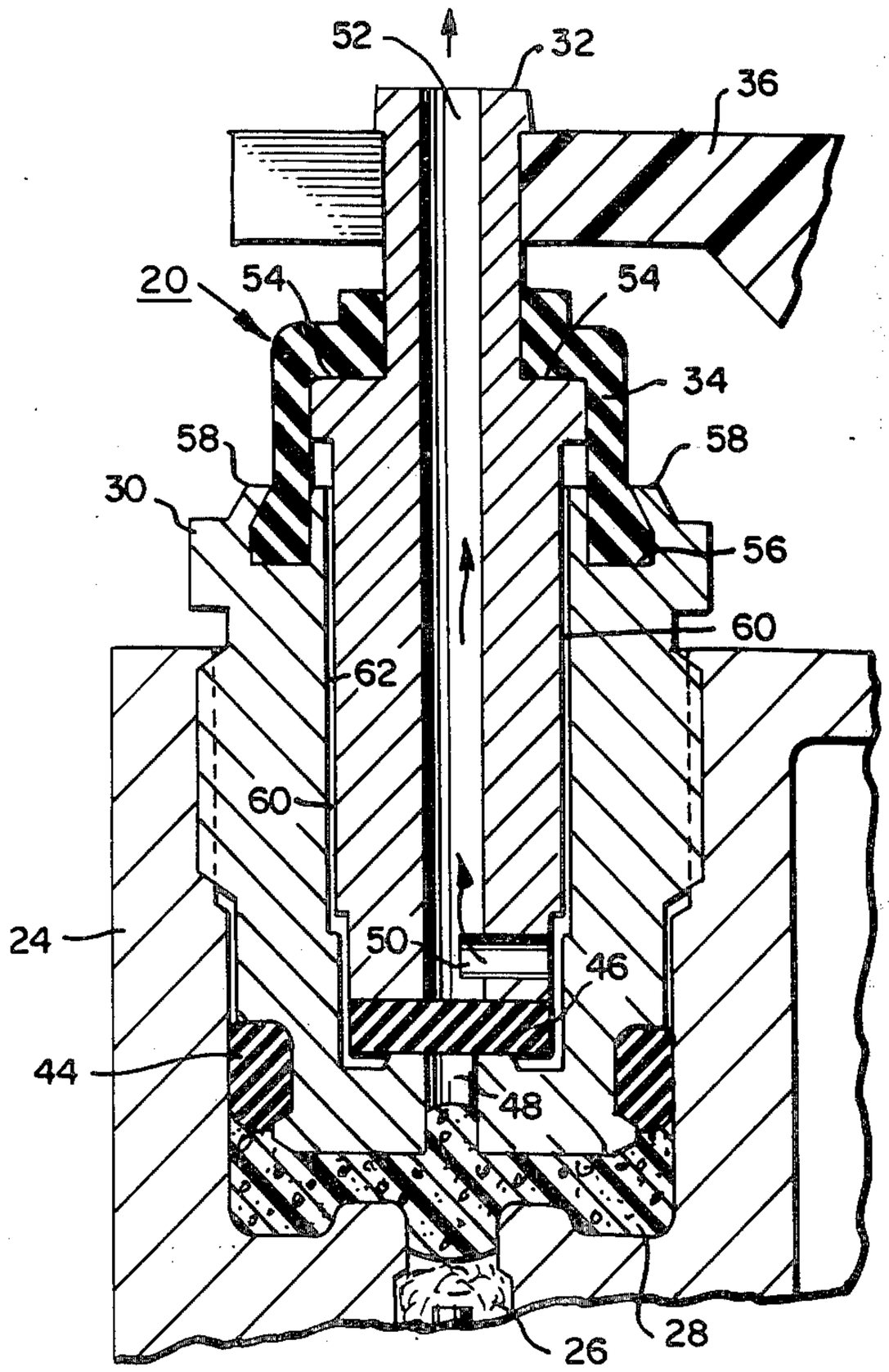


FIG. 1

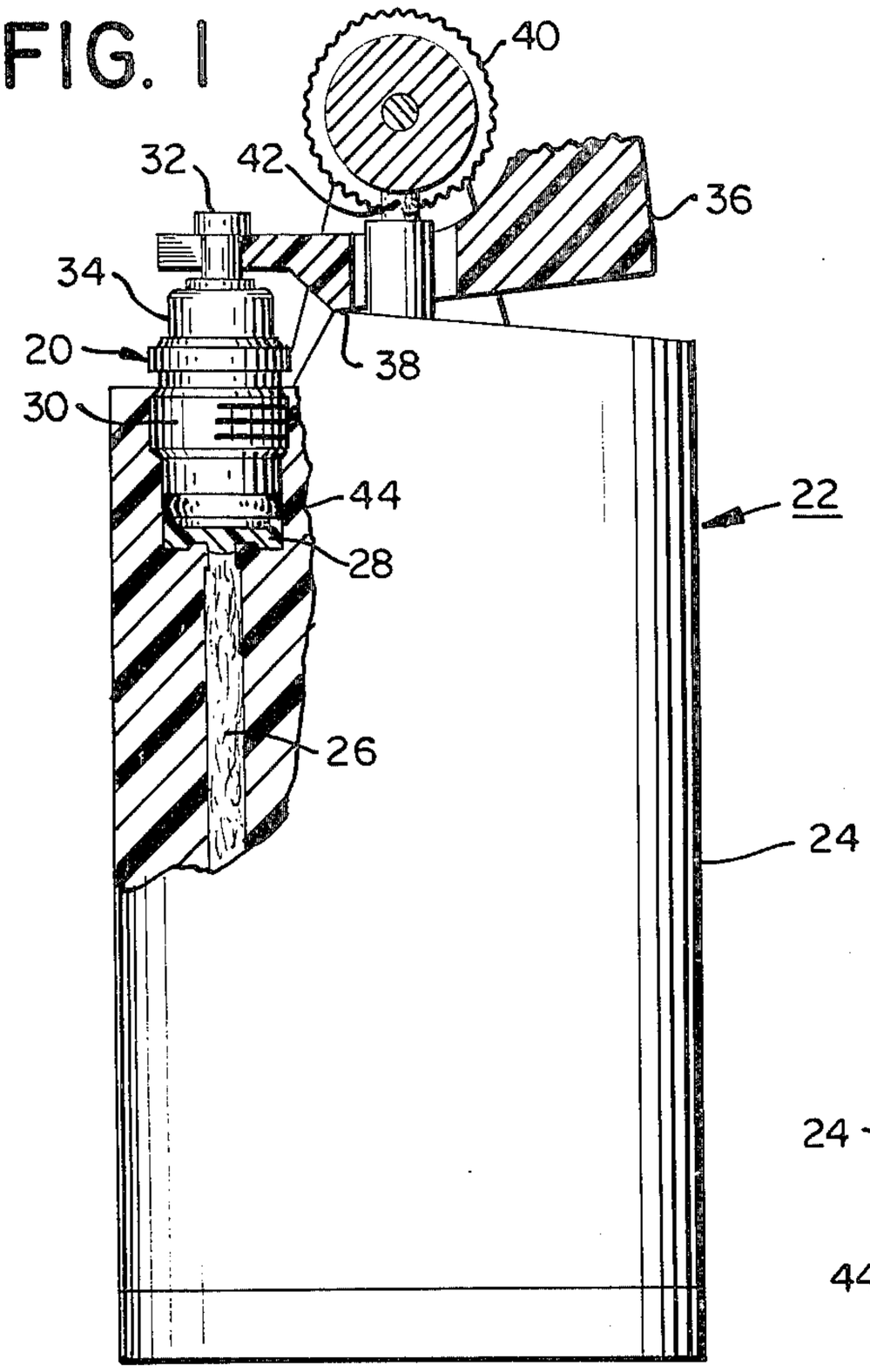


FIG. 2

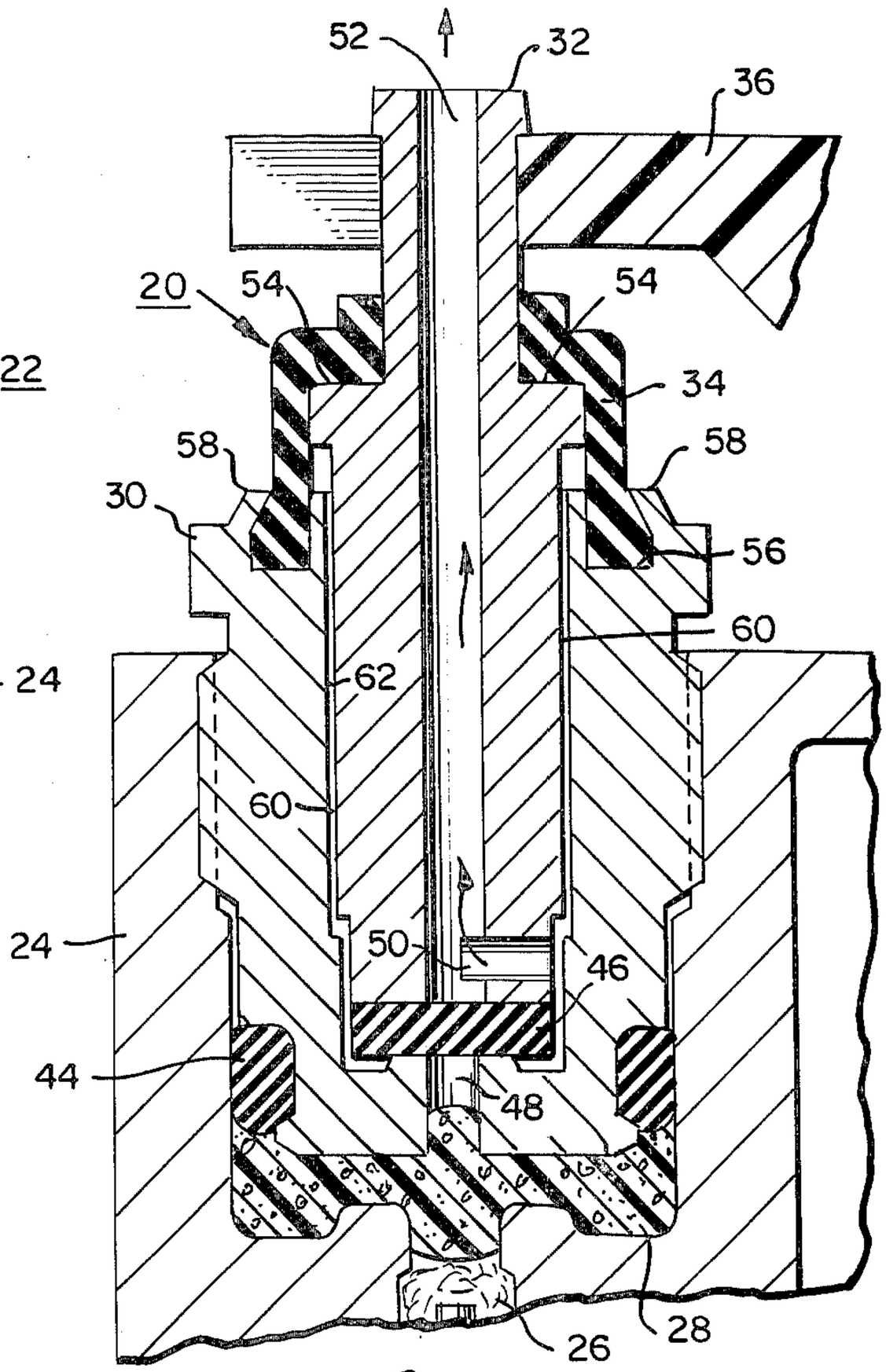


FIG. 3

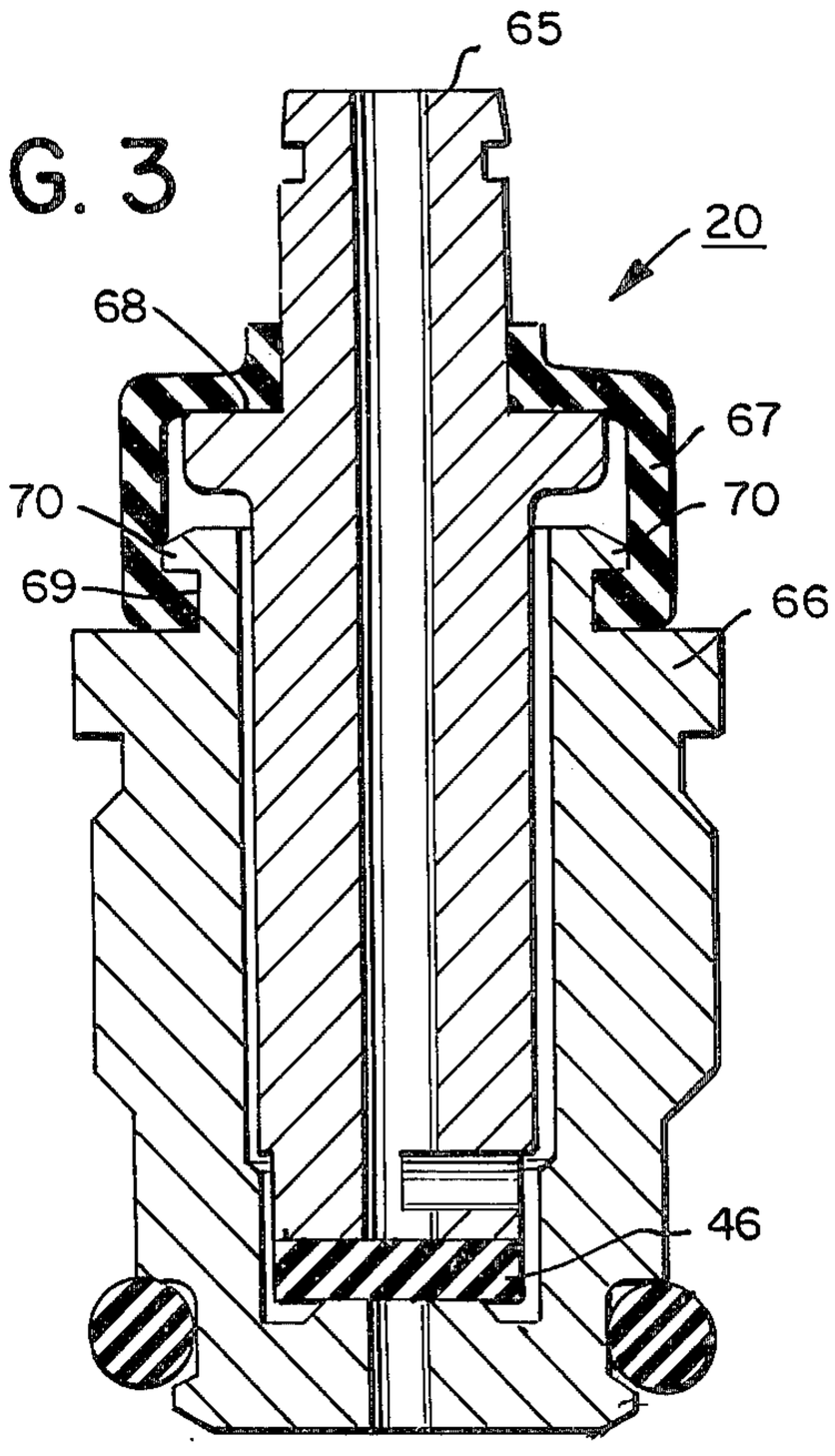


FIG. 4

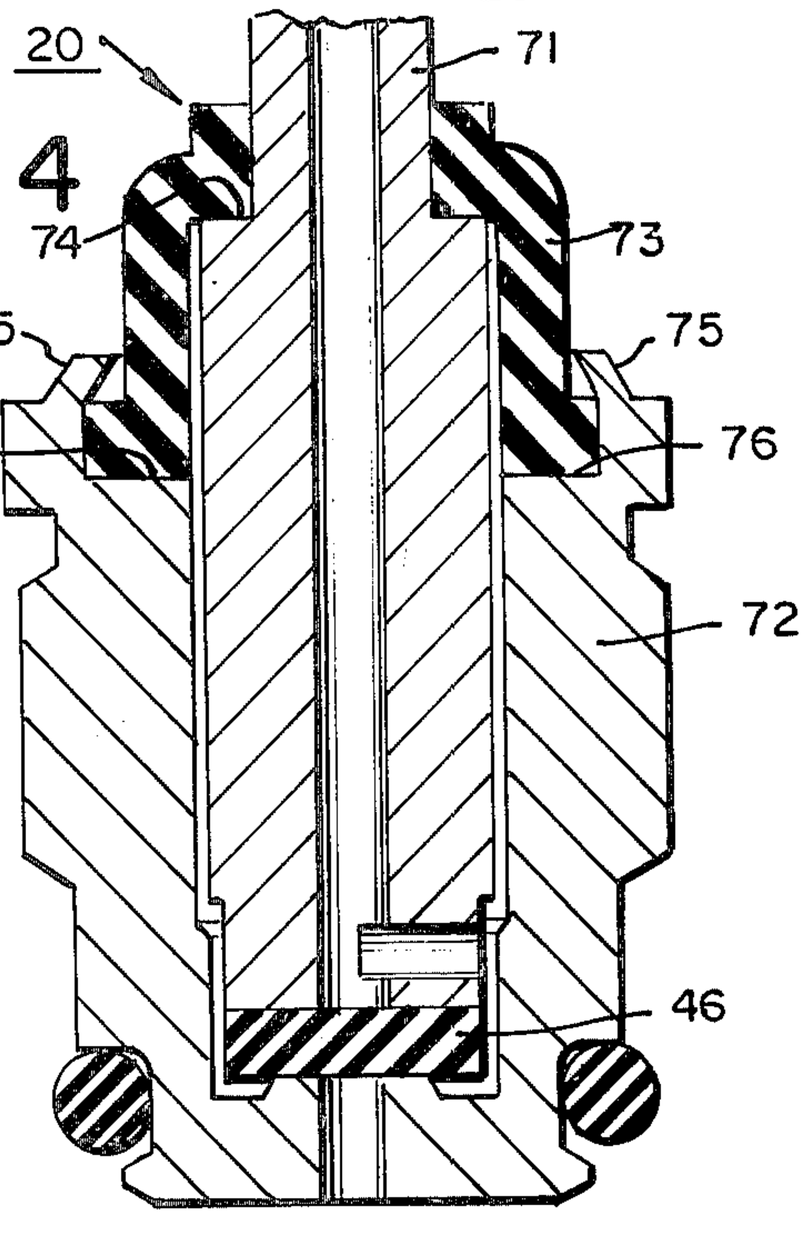


FIG. 5

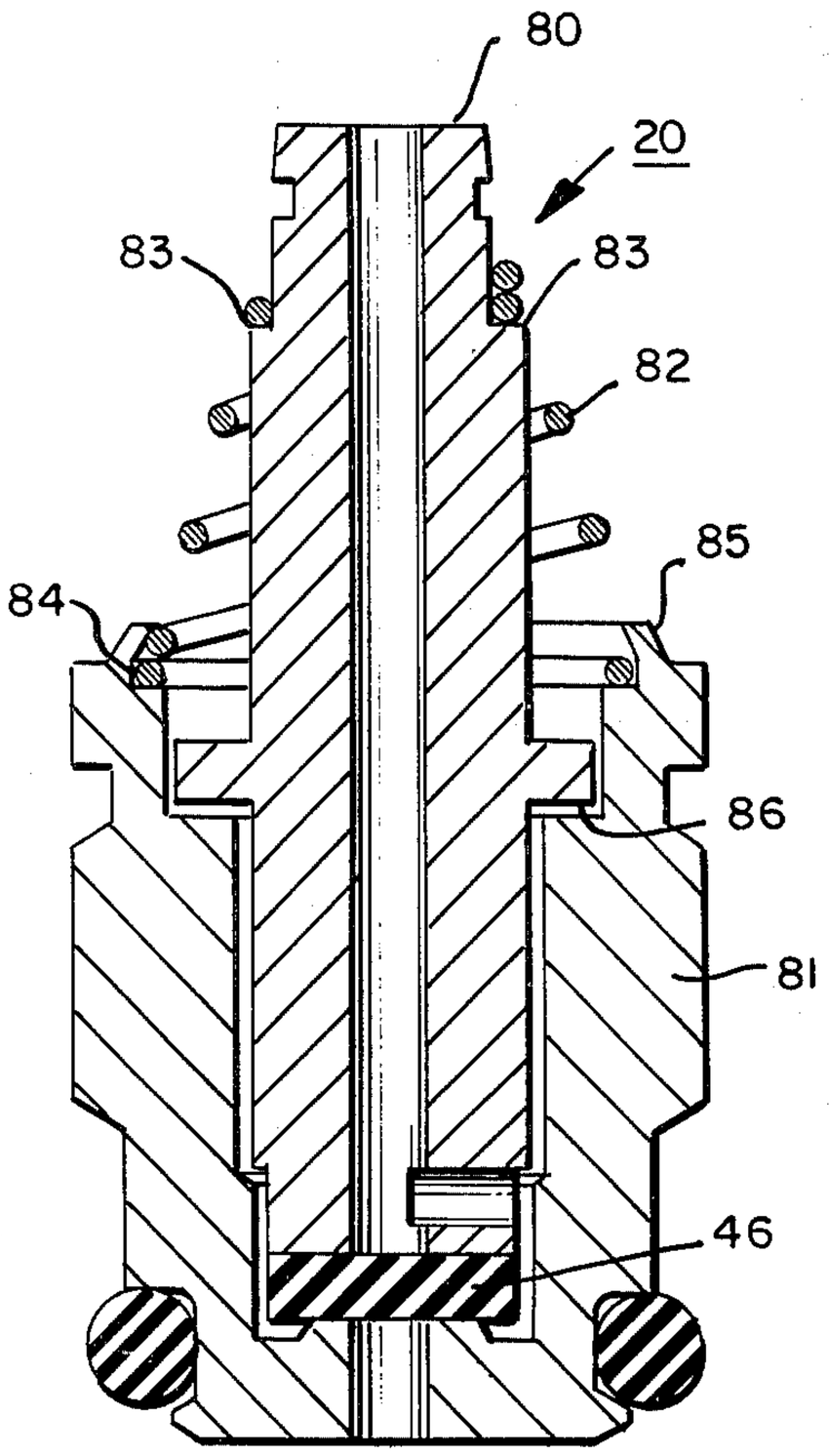
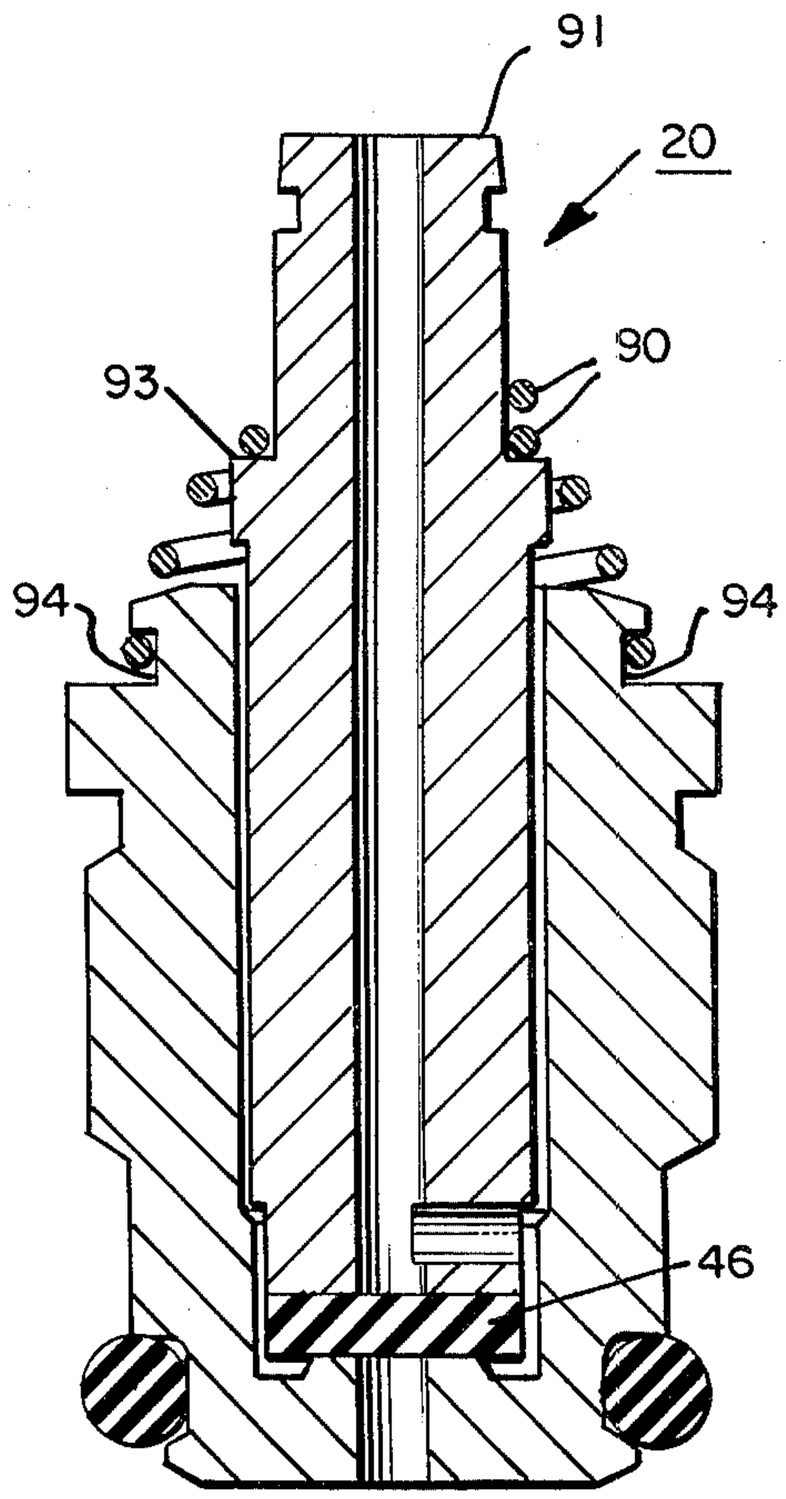


FIG. 6



VALVE ASSEMBLY

BACKGROUND OF THE INVENTION

This invention relates to valve assemblies, and more particularly to self-contained, captured valve assemblies.

Generally, all valve assemblies comprise a valve housing, having one portal exposed to the combustible fluid, and a valve stem, mounted within the housing and either in contact with the housing or a gasket material. The valve stem is movable from a closed position, preventing flow of the combustible fluid to an open position allowing the combustible material to pass through the valve stem.

Valve assemblies can generally be classified as either "captured" and "self-contained" or "uncaptured". The captured valve assemblies comprise a closed unit with the valve stem, valve housing, gasket material, if used, and biasing member enclosed therein forming a single unitary product. The uncaptured valve assemblies have each component separate, requiring a final assembly and an external member to bias the valve stem in the closed position.

The major difference between captured valve assemblies and uncaptured valve assemblies is the cost of manufacturing. In the captured, or self-contained, valve assembly, the biasing member, which is generally a spring, is mounted directly within the valve assembly under compression in a manner which biases the valve stem into the closed position with the valve housing. In order to produce a valve stem which will accomodate the captured spring and allow the valve stem to be biasingly engaged with the valve housing, the valve stem must be separately machined and, as a result, is an expensive item to manufacture. Consequently, the captured or self-contained valve assembly, although preferable in most applications since assembly is complete, is a more expensive valve assembly, due to the labor involved and the cost of manufacturing.

In the uncaptured valve assembly, the valve stem may be die-cast, since its construction is relatively simple compared to the captured valve stem. As a result, the uncaptured valve assembly is much less expensive than the captured valve assembly, but requires additional labor in its final assembly, as well as additional parts handling problems. Also, the uncaptured valve assembly requires an external biasing member to move the valve stem from a closed position to an open position and also to bias the valve stem in the closed position when combustible fluid flow is not desired.

An additional problem found uncaptured valve assemblies is leakage of the combustible fluid between the valve stem and the valve housing, which results in loss of fluid and can produce secondary ignition when the valve stem is in the open position. Secondary ignition is extremely undesirable since it can cause deterioration of the external member controlling the valve stem.

It is a principal object of this invention to provide a captured or self-contained valve assembly that is easy and inexpensive to manufacture and competitive with the cost of uncaptured valve assemblies.

Another object of this invention is to provide a captured or self-contained valve assembly of the above character which eliminates secondary ignition.

Another object of this invention is to provide a captured or self-contained valve assembly of the above character employing a die-cast or molded valve stem.

Other and more specific objects will in part be obvious and will in part appear hereinafter.

SUMMARY OF THE INVENTION

In the valve assembly of this invention, a die-cast or molded valve stem, similar to the type of valve stem employed in non-captured valve assemblies, is used in combination with a valve housing. However, a captured valve assembly is created by externally mounting a resilient flexible member about the valve stem and interconnecting the flexible member with the valve housing in tension so as to biasingly engage the valve stem with the valve housing. In this way, a completely captured or self-contained valve assembly is created having all of the advantages of a captured valve assembly while having the cost and component production advantages of an uncaptured valve assembly.

In the preferred embodiment, the flexible biasing member comprises a rubber material, which peripherally surrounds and engages the valve stem and the valve housing, and is mounted under sufficient tension to biasingly engage the valve stem in the closed position against the valve housing. As a result, the valve assembly of this invention is a completely closed or self-contained valve assembly ready for installation in a desired unit. Furthermore, this preferred embodiment which incorporates the peripherally surrounding rubber material prevents any escape of the combustible fluid between the walls of the valve stem and the valve houing, thereby eliminating leakage and secondary ignition.

The invention accordingly comprises an article of manufacture, possessing the features, properties, and the relation of elements which will be exemplified in the article hereinafter described, and the scope of the invention will be indicated in the claims.

THE DRAWINGS

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings, in which:

FIG. **1** is a side elevation view partially in cross section of a typical gas lighter employing the valve assembly of this invention;

FIG. **2** is a cross-sectional side elevation view of one embodiment of the valve assembly of this invention, taken along line **2**—**2** of FIG. **1**; and

FIGS. **3** through **6** are cross-sectional side elevation views of alternative embodiments of the valve assembly of this invention.

DETAILED DESCRIPTION

In FIG. **1**, valve assembly **20** is shown mounted in a typical gas lighter **22**. The description and operation of valve assembly **20** will be made in reference to gas lighter **22** for exemplary purposes only. As will be obvious to one skilled in the art, valve assembly **20** of this invention can be used in other suitable operations employing combustible fluid with the use of the valve assembly of this invention in gas lighter **22** being merely exemplary of that use.

As shown in FIGS. **1** and **2**, gas lighter **22** comprises a case **24** in which combustible fluid is contained. Presently, liquified butane is employed in many of the gas lighters. The combustible fluid is brought to a metering

gasket **28** by means of wick **26.** Both wick **26** and metering gasket **28** are particularly useful with butane fuel.

Valve assembly **20** is threadedly engaged with housing **24** of lighter **22,** and comprises a housing **30** and a valve stem **32.** As is more fully described below, valve stem **32** is biasingly engaged in housing **30** in a closed position by means of resiliently flexible biasing member **34.** This is achieved by securing flexible member **34** to valve stem **32** and housing **30** in tension.

Since valve stem **32** is held in the closed position by flexible member **34,** lever **36** is employed to move valve stem **32** vertically upward into the open position. Lever **36** incorporates a pivot point **38** and when lever **36** is moved downwardly, lever **36** pivots about pivot point **38,** causing valve stem **32** to move upwardly into the open position, placing flexible member **34** under additional tension. When spark wheel **40** is rotated causing a spark to be produced by the friction between spark wheel **40** and flint **42,** the gas escaping through valve stem **32** is ignited. Then, when the flame is to be extinguished, the downward force on lever **36** is removed and the resilient forces of flexible member **34** causes valve stem **32** back to the closed position.

By referring to FIG. **2,** the contruction and operation of one embodiment of valve assembly **20** of this invention can best be understood. Housing **30** of valve assembly **20** is threadedly engaged with case **24** of lighter **22,** and is sealed therein by means of O-ring seal **44.** In the normal position, flexible member **34** is under sufficient tension to biasingly engage valve stem **32** with valve housing **30,** maintaining valve stem **32** in the closed position by exerting sufficient force on valve stem **32** to maintain it in contact with gasket **46.** As a result, the combustible fluid which passes through wick **26** and metering pad **28** into the portal **48** of housing **30** cannot enter into valve stem **32** when valve stem **32** is in the closed position. When lever **36** is moved, as discussed above, causing valve stem **32** to move upwardly, the combustible fluid enters portal **50** of valve stem **32** and passes through the center hole **52** of valve stem **32.**

In the embodiment shown in FIG. **2,** flexible member **34** is made of a rubber material and at one end peripherally surrounds valve stem **32,** captured by ledge **54** of valve stem **32.** The other end of flexible member **34** is secured within annular groove **56** of valve housing **30,** retained therein by captured, fold-over detent **58.** The dimensions between ledge **54** of valve stem **32** and groove **56** of housing **30** are made to assure that the proper amount of biasing pressure is exerted by flexible material **34** in order to maintain valve stem **32** sealed against gasket **56** in the normally closed position. However, flexible member **34** comprises sufficient elasticity which allows member **34** to stretch when arm **36** is moved and allow valve **32** to move upwardly, providing the desired combustible fluid flow. Furthermore, the resiliency of flexible member **34** assures that when the force is removed from lever **36** valve stem **32** is immediately returned to the normally closed position, securely blocking any further combustible fluid flow.

In this way, a completely captured or self-contained valve assembly is achieved with a minimum of parts without requiring a valve stem incorporating a plurality of various offset lands and grooves, as is required in prior art self-contained valve assemblies. In the captured or self-contained valve assembly of this invention, valve stem **32** can be manufactured by die-casting or molding or other similar processes used for manufacturing valve stems of the non-captured valve assembly types. As a result, the valve stem employed in the captured valve assembly of this invention is extremely less expensive than the valve stem employed in prior art captured valve assemblies.

An additional problem found with prior art non-captured valve assemblies is leakage of the combustible fluid and secondary ignition of this leaking fluid. Generally, when valve stem **32** has been raised in order to allow flow of the combustible fluid, through the valve stem, leakage may occur between outer wall **60** of valve stem **32** and inner wall **62** of valve housing **30.** The only deterrent to this type of gas leakage is the tolerances which are employed for these interfitting parts. However, even though close tolerances are generally maintained, leakage does occur and can be ignited by the spark, causing undesirable deterioration of the surrounding parts.

By employing the captured valve assembly **20** of this invention, all of the cost advantages of a non-captured valve assembly are achieved, while also having all of the positive advantages of a captured valve assembly. One of these advantages is the complete elimination of all leakage and secondary ignition when employing the preferred embodiment of valve assembly **20.** Gas leakage is completely prevented by the preferred embodiment of valve assembly **20,** since biasing member **34** completely surrounds valve stem **32** and housing **30,** providing a positive seal against escape of any gas between wall **60** of valve stem **32** and wall **62** of valve housing **30.**

In FIGS. **3** and **4,** additional embodiments of the valve assembly **20** of this invention are shown. These additional embodiments are shown merely for illustrative purposes in order to represent the various configurations that can be employed for a peripherally surrounding flexible member which biases the valve stem in the closed position with the valve housing, while also allowing sufficient resiliency to allow raising of the valve stem into an open position, while also resiliently returning said valve stem into the closed position when the raising force is eliminated.

In the embodiment shown in FIG. **3,** valve stem **65** cooperates with valve housing **66** and is interconnected therewith and biasingly engaged in the closed position by flexible member **67.** Although valve stem **65** has a slightly different configuration than valve stem **32** of FIG. **2,** valve stem **65** is still manufacturable by die-casting or molding, and therefor can be manufactured in the less expensive manner similar to non-captured valve assemblies. Furthermore, flexible member **67** peripherally surrounds valve stem **65** maintained in its position by land **68,** while being captured by peripherally surrounding groove **69** and tab **70** of valve housing **66.** In this way, another embodiment for a captured valve assembly of this invention having all of the attributes of more expensive prior art captured valve assemblies is provided.

In FIG. **4,** a third embodiment of the captured valve assembly of this invention is shown with valve stem **71** mounted within valve housing **72** and biasingly engaged therewith in the closed position by flexible biasing member **73.** As with the other embodiment shown and discussed above, valve assembly **71** has an alternative configuration to the other embodiments. However, as with these other embodiments, valve stem **71** is capable of manufacture in the less expensive die-cast or mold-

ing processes. Flexible biasing member **73** peripherally surrounds and engages valve stem **71** retained thereon by ledge **74** near one end and at its other end is captured by tabs **75** and groove **76** of housing **72.** In this way, as with the prior embodiments, flexible member **73** is mounted in tension and maintains valve stem **72** biased in the closed position against gasket **46,** while also being resilient and flexible enough to allow valve stem **71** to be raised to an open position, increasing the tension thereon, and then resiliently biasingly return and hold valve stem **71** in the closed position against gasket **46.**

In all of the embodiments discussed above, a flexible peripherally surrounding biasing member, preferably comprising a rubber composition, is disclosed. This biasing flexible member is preferred in order to provide a positive seal against leakage and secondary ignition. However, if the tolerances of the valve stem and the valve housing are maintained in order to provide a close sliding engagement between the two components of the valve assembly, the rubberlike material need not be employed and a coil spring could be employed to provide the desired biasing forces. Two alternative embodiments employing coil springs are shown in FIGS. **5** and **6.**

In FIG. **5,** one embodiment of valve assembly **20** of this invention is shown with valve stem **80** mounted in place within valve housing **81,** biasingly maintained in the closed position against gasket **46** by coil spring **82.** In this embodiment, coil spring **82** comprises a conical-shaped coil spring mounted at one end about valve stem **80** retained in this position by land portion **83** and secured at its other end to valve housing **81** within groove **84** maintained and captured in this position by fold-over tab **85.** As discussed above, spring **82** is mounted to valve assembly **20** in tension in order to assure that valve stem **80** is normally maintained against gasket **46,** assuring valve assembly **20** is in the closed position. The desired pressure necessary to maintain valve stem **80** in this closed position depends upon the specific requirements of the use for valve assembly **20,** and can range anywhere from 0.25 lbs. per sq. in. to several lbs. per sq. in. As will be obvious to one skilled in the art, specific spring tensions or rubber materials would be provided on the valve assembly in order to assure the desire biasing forces, while also being resilient enough to allow stretching to the open position and biasing resilient return to the closed position.

Valve stem **80** also incorporates a radially extending shelf portion **86** in order to provide an additional deterrent to gas leakage and secondary ignition. Although coil spring **80** does not provide the positive seal against gas leakage between the outer wall of valve stem **80** and the inner wall of valve housing **81,** radially extending shelf **86** does provide an additional deflection baffle around which the gas must pass before it could emerge from housing **81** and be ignited. It has been found that the inclusion of such a deflection baffle provides sufficient deterrent to gas leakage in most normal situations, thereby substantially eliminating secondary ignition difficulties. Furthermore, valve stem **80** can be manufactured by molding or die-cast processes, and is therefore inexpensive to manufacture. Therefore, a valve assembly having the cost features of an uncaptured valve assembly is provided with all of the desirable features of a captured valve assembly.

In FIG. **6,** an alternative mounting arrangement for securing coil spring **90** to valve stem **91** and housing **92** is shown. In this embodiment, one end of coil spring **90** peripherally surrounds valve stem **91** retained in this position by shelf **93.** The other end of coil spring **90** is captured within peripherally surrounding recess **94** of valve housing **92.** This configuration has assembly advantages since coil spring **90,** which is preferably of an overall conical shape, can be quickly and easily placed over valve stem **90,** retaining one end about shelf **93** and snapping the other end within recess **94** of housing **92.** In this way, a captured valve assembly is quickly and easily provided which maintains valve stem **90** in the closed position firmly engaged against gasket **46,** while still being capable of resiliently stretching to an open position and then biasingly returning to the closed secured position. Also, since valve stem **91** is manufacturable by the less expensive processes discussed above, this embodiment of the valve assembly of this invention provides another efficient captured valve assembly which is quickly and rapidly assemblable, using inexpensive parts and providing all of the features of the more expensive prior art captured valve assemblies.

As would be obvious to one skilled in the art, many variations of construction for the valve assembly of this invention are possible. Several various embodiments have been disclosed for exemplary purposes in order to show some of these possible variations. However, it is believed that the essential feature of providing an inexpensive captured valve assembly is clearly obtainable, employing the teaching of this invention, by providing a valve stem and a valve housing with an externally mounted flexible member which biasingly engages the valve stem in the closed position with the valve housing, while still being capable of flexing to an open valve position and resiliently biasing said valve assembly into the closed position when the opening force has been removed.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the above article without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sence.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A leak-free valve assembly comprising:

a. a housing incorporating

a. a combustible fluid portal positioned for receiving and passing said combustible fluid therethrough,

b. an internal chamber extending substantially the entire length of said housing and communicating with said fluid portal;

b. a hollow valve stem a major portion of which is slidably mounted within said internal chamber of said housing, the remainder of which extends therefrom above said housing, said valve stem being movable from a first closed position to a second open, fluid flow position;

c. a flexible, leak-preventing member peripherally surrounding and encapsulating portions of said housing and said valve stem, with

a. one end thereof sealingly engaged about a shoulder of the valve stem above the housing with the valve stem extending through and above said member, and

b. the remainder thereof extending therefrom peripherally surrounding the valve stem, with the other end pressed between opposed upper portions of said housing and biasing the valve stem into a closed position,

whereby leakage between the outer peripheral surface of the valve stem and the inner chamber of the housing to the atmosphere is completely eliminated by said leak-preventing member completely sealing any leakage zone.

2. The valve assembly defined in claim **1,** wherein said flexible, leak-preventing member comprises a rubber material.

3. The valve assembly defined in claim **1,** wherein said flexible, leak-preventing member is mounted between said valve stem and said housing under tension.

4. A leak-free valve assembly mounted within a gas lighter comprising;

A. a housing

a. threadedly engaged in a substantially sealed configuration with said gas lighter,

b. incorporating a combustible fluid portal positioned for passage of said combustible fluid therethrough, and

c. an inner chamber extending substantially the entire length of said housing and communicating with said fluid portal;

B. sealing means mounted within said housing and positioned at the exit end of said fluid flow portal for reducing fluid leakage between the walls of a valve stem and said inner chamber;

C. a valve stem

a. a major portion of which is slidably mounted within said chamber of said housing with the end

associated therewith in abutting contact with said sealing means, and

b. the remainder of said valve stem extending from said housing with its associated end responsive to lever means for raising said valve stem from a first closed position to a second open position;

D. a flexible, self-biasing, leak-preventing, rubber-like member peripherally surrounding and encapsulating portions of said housing and said valve stem, with

a. one end thereof securely engaged about a shoulder of said valve stem above said housing, and

b. the remainder thereof extending therefrom under tension periphperally surrounding the valve stem, with the other end pressed between opposed upper portions of said housing, whereby said valve stem is normally biasingly engaged with said housing in said first closed position and leakage through said sealing means and between the walls of the valve stem and the inner chamber of the housing to the atmosphere is completely prevented by said self-biasing, leak-preventing rubber-like member, and

E. lever means engaged about the exposed end of said valve stem and positioned for counteracting said biasing engaging forces of said flexible, self-biasing, leak-preventing, rubber-like member by raising said valve stem from the closed position to an open position in response to an external force,

whereby said valve assembly is normally in the closed position maintained therein by said flexible self-biasing, rubber-like member which provides for elastic movement of said valve stem to the open position in response to the external force on the lever means for the biasingly resilient return of the valve stem to said closed position upon removal of said force from said lever means, and secondary ignition completely eliminated by sealing the entire vented area between the walls of the valve stem and the inner chamber of the housing by said leak-preventing, rubber-like member.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 3,961,876

DATED : June 8, 1976

INVENTOR(S) : Stephen P. Chernock

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, Line 33, "accomodate" should be --accommodate--

Column 2, Line 33, "houing" should be --housing--

Column 6, Line 47, "sence" should be --sense--

Column 6, Line 56 through Column 7, Line 12 is changed to read as corrected below:

A) a housing incorporating
   a) a combustible fluid portal positioned for receiving and passing said combustible fluid therethrough,
   b) an internal chamber extending substantially the entire length of said housing and communicating with said fluid portal;

B) a hollow valve stem a major portion of which is slidably mounted within said internal chamber of said housing, the remainder of which extends therefrom above said housing, said valve stem being movable from a first closed position to a second open, fluid flow position;

C) a flexible, leak-preventing member peripherally surrounding and encapsulating portions of said housing and said valve stem, with
   a) one end thereof sealingly engaged about a shoulder of the valve stem above the housing with the valve stem extending through and above said member, and
   b) the remainder thereof extending therefrom peripherally surrounding the valve stem, with the other end pressed between opposed upper portions of said housing and biasing the valve stem into a closed position,

Signed and Sealed this

Twelfth Day of October 1976

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks